CLAIMS

What is claimed is:

1. A system for multicasting a data payload through an optical network composed of a plurality of nodes interconnected by links wherein a given one of the nodes multicasts over two outgoing links, the data payload having a given format and protocol, the system comprising

a route generator for generating and storing a local routing look-up table in each of the nodes, each local look-up table listing local addresses for determining alternative local routes through each of the nodes,

an adder for adding two headers to the data payload with each of the headers being embedded in the same wavelength as the data payload prior to inputting the data payload at an input one of the nodes to produce an optical signal, each of the headers having a format and protocol and conveying multicast information indicative a local route through the given node for the data payload and the headers, the format and protocol of the data payload being independent of the format and protocol of the headers,

a detector for detecting the multicast information at the given one of the nodes to determine two switch control signals with reference to the multicast information as the data payload and the headers propagate through the optical network,

an optical splitter for splitting the optical signal into two split optical signals,

a selector for selecting two local routes through the given one of the nodes in correspondence to the two switch control signals,

an optical switch having input ports and output ports wherein one of the split optical signals couples to a first input port and the second of the split optical signals couples to a second input port, and wherein one of the outgoing links couples to a first output port and the second of the outgoing links couples to a second output port, and

a switch controller, coupled to the optical switch and responsive to the two switch control signals, for switching the optical switch in response to the multicast information to optically couple the first input port with the first output port and the second input port with the second output port,

wherein the headers are conveyed by a single-sideband signal occupying a given frequency band above the data payload,

the detector further comprising

an optical notch filter for filtering the optical signal with a transmission part of the notch filter to detect the headers and for filtering the optical signal with a reflective part of the notch filter to delete the headers and recover the data payload, and

a processor, coupled to the notch filter, for processing the headers to obtain the multicast information, and

the system further comprising means, coupled to the notch filter, for inserting new single-sideband headers at the given frequency band into the optical signal in place of the deleted headers.

2. The system as recited in claim 1 wherein the adder includes a generator for generating a plurality of baseband headers, each of the baseband headers conveying a subset of the multicast information and determining one of the switch control signals.

3. The system as recited in claim 2 further including

a plurality of local oscillators, and

a mixer for mixing the baseband headers with the corresponding plurality of local oscillators to produce frequency-shifted baseband signal.

4. The system as recited in claim 3 further including a combiner for combining the data payload at baseband with the frequency-shifted baseband signal to produce a composite baseband signal.

5. The system as recited in claim 4 further including

a laser source, and

an optical modulator for optically modulating the composite baseband signal with the laser source to produce the optical signal.

6. The system as recited in claim 5 wherein each of the headers is conveyed by a distinct sub-carrier frequency occupying a frequency band above the data payload, and the detector includes

means for detecting the headers to obtain the multicast information, and

a processor for processing the multicast information to obtain the switch control signals for routing the optical signal.

7. The system as recited in claim 1 wherein the detector includes a header detector, coupled to the switch controller, for detecting the multicast information in the headers to produce the two switch control signals, in correspondence to the two split optical signals, for the switch controller to operate the optical switch.

8. The system as recited in claim 1 wherein the optical signal arriving at the given one of the nodes is included in a composite optical signal, the system further comprising an optical demultiplexer for demultiplexing the composite optical signal to recover the optical signal.

9. A system for multicasting a data payload through an optical network composed of a plurality of nodes interconnected by links wherein a given one of the nodes multicasts over a plurality of outgoing links, the data payload having a given format and protocol, the system comprising

a route generator for generating and storing a local routing look-up table in each of the nodes, each local look-up table listing local addresses for determining alternative local routes through each of the nodes,

an adder for adding a plurality of headers to the data payload with the headers being embedded in the same wavelength as the data payload prior to inputting the data payload at an input one of the nodes to produce an optical signal, the headers having a format and protocol and conveying multicast information indicative of local routes through the given node for the data payload and the headers, the format and protocol of the data payload being independent of the format and protocol of the headers,

a detector for detecting the multicast information at the given one of the nodes to determine switch control signals with reference to the multicast information as the data payload and the headers propagate through the optical network,

an optical splitter for splitting the optical signal into a plurality of split optical signals,

a selector for selecting a plurality of local routes through the given one of the nodes in correspondence to the switch control signals,

an optical switch having input ports and output ports wherein each of the split optical signals couples to separate input ports, and wherein each of the outgoing links couples to corresponding output ports, and

a switch controller, coupled to the optical switch and responsive to the switch control signals, for switching the optical switch in response to the multicast information to optically couple the separate input ports with the corresponding output ports,

wherein the headers are conveyed by a single-sideband signal occupying a given frequency band above the data payload,

the detector further comprising

an optical notch filter for filtering the optical signal with a transmission part of the notch filter to detect the headers and for filtering the optical signal with a reflective part of the notch filter to delete the headers and recover the data payload, and

a processor, coupled to the notch filter, for processing the headers to obtain the multicast information, and

the system further comprising means, coupled to the notch filter, for inserting new single-sideband headers at the given frequency band into the optical signal in place of the deleted headers.

10. The system as recited in claim 9 wherein the adder includes a generator for generating a plurality of baseband headers, each of the baseband headers conveying a subset of the multicast information and determining one of the switch control signals.

11. The system as recited in claim 10 further including

a plurality of local oscillators, and

a mixer for mixing the baseband headers with the corresponding plurality of local oscillators to produce frequency-shifted baseband signal.

12. The system as recited in claim 11 further including a combiner for combining the data payload at baseband with the frequency-shifted baseband signal to produce a composite baseband signal.

13. The system as recited in claim 12 further including

a laser source, and

an optical modulator for optically modulating the composite baseband signal with the laser source to produce the optical signal.

14. The system as recited in claim 13 wherein each of the headers is conveyed by a distinct sub-carrier frequency occupying a frequency band above the data payload, and the detector includes

means for detecting the headers to obtain the multicast information, and

a processor for processing the multicast information to obtain the switch control signals for routing the optical signal.

15. The system as recited in claim 9 wherein the detector includes a header detector, coupled to the switch controller, for detecting the multicast information in the headers to produce the two switch control signals, in correspondence to the two split optical signals, for the switch controller to operate the optical switch.

16. The system as recited in claim 9 wherein the optical signal arriving at the given one of the nodes is included in a composite optical signal, the system further comprising an optical demultiplexer for demultiplexing the composite optical signal to recover the optical signal.

17. A system for multicasting a data payload through an optical network composed of a plurality of nodes interconnected by links wherein a given one of the nodes multicasts over a plurality of outgoing links, the data payload having a given format and protocol, the system comprising

a route generator for generating and storing a local routing look-up table in each of the nodes, each local look-up table listing local addresses for determining alternative local routes through each of the nodes,

an adder for adding a plurality of headers to the data payload with the headers being embedded in the same wavelength as the data payload prior to inputting the data payload at an input one of the nodes to produce an optical signal, the headers having a format and protocol and conveying multicast information indicative of local routes through the given node for the data payload and the headers, the format and protocol of the data payload being independent of the format and protocol of the headers,

a detector for detecting the multicast information at the nodes to determine switch control signals with reference to the multicast information as the data payload and the headers propagate through the optical network,

an optical splitter for splitting the optical signal into a number of split optical signals corresponding to number of outgoing links,

an optical switch having input ports and output ports wherein each of the split optical signals couples to a corresponding one of the input ports,

an optical combiner coupled to predetermined ones of the output ports, ,

a plurality of multiplexers for coupling the optical combiner with the outgoing links, and

a switch controller, coupled to the optical switch and responsive to the switch control signals, for switching the optical switch in response to the multicast information to optically couple the input ports with corresponding output ports,

wherein the headers are conveyed by a single-sideband signal occupying a given frequency band above the data payload,

the detector further comprising

an optical notch filter for filtering the optical signal with a transmission part of the notch filter to detect the headers and for filtering the optical signal with a reflective part of the notch filter to delete the headers and recover the data payload, and

a processor, coupled to the notch filter, for processing the headers to obtain the multicast information, and

the system further comprising means, coupled to the notch filter, for inserting new single-sideband headers at the given frequency band into the optical signal in place of the deleted headers.

18. A system for multicasting a data payload through an optical network composed of a plurality of nodes interconnected by links wherein a given one of the nodes multicasts over two outgoing links, the data payload having a given format and protocol, the system comprising

a route generator for generating and storing a local routing look-up table in each of the nodes, each local look-up table listing local addresses for determining alternative local routes through each of the nodes,

an adder for adding two headers to the data payload with the headers being embedded in the same wavelength as the data payload prior to inputting the data payload at an input one of the nodes to produce an optical signal, the headers having a format and protocol and conveying multicast information indicative of local routes through the given node for the data payload and the headers, the format and protocol of the data payload being independent of the format and protocol of the headers,

a detector for detecting the multicast information at the nodes to determine two switch control signals with reference to the multicast information as the data payload and the headers propagate through the optical network,

a one-by-two optical splitter for splitting the incoming optical signal into two split optical signals,

a four-by-four optical switch having four input ports and four output ports wherein the two split optical signals couple to the first and second input ports,

a first two-by-one optical combiner coupled to the first and second output ports,

a second two-by-one optical combiner coupled to the third and fourth output ports,

a first multiplexer coupled to the first optical combiner and the second optical combiner wherein the output of the first multiplexer is coupled to one of the two outgoing links,

a second multiplexer coupled to the first optical combiner and the second optical combiner wherein the output of the second multiplexer is coupled to the other of the two outgoing links, and

a switch controller, coupled to the optical switch and responsive to the switch control signals, for switching the optical switch in response to the multicast information to couple the first input port with the first output port and the second input port with the third output port,

wherein the headers are conveyed by a single-sideband signal occupying a given frequency band above the data payload,

the detector further comprising

an optical notch filter for filtering the optical signal with a transmission part of the notch filter to detect the headers and for filtering the optical signal with a reflective part of the notch filter to delete the headers and recover the data payload, and

a processor, coupled to the notch filter, for processing the headers to obtain the multicast information, and

the system further comprising means, coupled to the notch filter, for inserting new single-sideband headers at the given frequency band into the optical signal in place of the deleted headers.

19. The system as recited in claim 18 wherein the detector includes a header detector, coupled to the switch controller, for detecting the multicast information in the headers to produce the two switch control signals, in correspondence to the two split optical signals, for the switch controller to operate the optical switch.

20. The system as recited in claim 19 wherein the optical signal to the given one of the nodes is included in a composite optical signal, the system further comprising an optical demultiplexer for demultiplexing the composite optical signal to recover the optical signal.

21. The optical system as recited in claim 18 for multicasting a second incoming optical signal to the two outgoing links, the second incoming optical signal including a second set of two headers for conveying second multicasting information, the system further comprising

a second one-by-two optical splitter for splitting the second incoming optical signal into two split second optical signals,

wherein the second two-by-one optical combiner is coupled to the third and fourth output ports of the optical switch, and

wherein said switch controller, being responsive to the second header, switches the optical switch in response to the second multicast information to couple the third input port with the second output port and the fourth input port with the fourth output port.

22. A system for multicasting two data payloads through an optical network composed of a plurality of nodes interconnected by links wherein a given one of the nodes multicasts over two outgoing links, each data payload having a given format and protocol, the system comprising

a route generator for generating and storing a local routing look-up table in each of the nodes, each local look-up table listing local addresses for determining alternative local routes through each of the nodes,

an adder for adding two headers to each data payload with each set of two headers being embedded in the same wavelength as each corresponding data payload prior to inputting each data payload at an input one of the nodes to produce two optical signals, the headers having a format and protocol and conveying multicast information indicative of local routes through the given node for each data payload and each corresponding header, the format and protocol of each data payload being independent of the format and protocol of each corresponding header,

a first demultiplexer for detecting the first optical signal,

a second demultiplexer for detecting the second optical signal,

a first one-by-two optical splitter, coupled to the first demultiplexer, for splitting the first optical signal into two split first optical signals,

a second one-by-two optical splitter, coupled to the second demultiplexer, for splitting the second optical signal into two split second optical signals,

a detector for detecting the multicast information at the given one of the nodes to determine four switch control signals with reference to the multicast information each of the data payloads and the corresponding headers propagate through the optical network,

a first four-by-four optical switch having four input ports and four output ports wherein the first split optical signals couple to the first and second input ports,

a second four-by-four optical switch having four input ports and four output ports wherein the second split optical signals couple to the first and second input ports,

a first two-by-one optical combiner coupled to the first and second output ports of the first optical switch,

a second two-by-one optical combiner coupled to the third and fourth output ports of the first optical switch,

a third two-by-one optical combiner coupled to the first and second output ports of the second optical switch,

a fourth two-by-one optical combiner coupled to the third and fourth output ports of the second optical switch,

a first multiplexer coupled to the first optical combiner and the second optical combiner wherein the output of the first multiplexer is coupled to one of the two outgoing links,

a second multiplexer coupled to the first optical combiner and the second optical combiner wherein the output of the second multiplexer is coupled to the other of the two outgoing links, and

a switch controller, coupled to the first optical switch and the second optical switch and responsive to the switch control signals, for switching the first optical switch and second optical switch in response to the multicast information to couple the first input port with the first output port of the first optical switch, the second input port with the third output port of the first optical switch, the first input port with the first

output port of the second optical switch, and the second input port with the third output port of the second optical switch,

wherein the headers are conveyed by a single-sideband signal occupying a given frequency band above the data payload,

the detector further comprising

an optical notch filter for filtering the optical signal with a transmission part of the notch filter to detect the headers and for filtering the optical signal with a reflective part of the notch filter to delete the headers and recover the data payload, and

a processor, coupled to the notch filter, for processing the headers to obtain the multicast information, and

the system further comprising means, coupled to the notch filter, for inserting new single-sideband headers at the given frequency band into the optical signal in place of the deleted headers.